

## **REMARKS / ARGUMENTS**

The Examiner has stated that he's fully considered Applicant's arguments, but does not find them persuasive, having set forth reasons why the arguments were not persuasive. However, Applicant will now point out how the reasons are flawed.

Applicant has argued that Burns teaches away from using geometric models in col. 3, lines 24-30, as well as col. 1, lines 64-67, and col. 2, lines 1-19. Applicant will now add further that the entire approach of Burns teaches away from Applicant's invention, since the teaching of Burns is clearly NOT what is warned against in the Background section, i.e., Burns teaches an alternative to "relatively indistinct features , such as line junctions, elliptical arcs, or edge points, for example" col. 2, lines 17-19. Further, Burns EXPLICITLY teaches away in the DETAILED DESCRIPTION, just as was done in the Background section, at col. 6, lines 23-26: the "encoding generally provides significantly more detailed information about image features than, for example, mere line junctions, elliptical arcs or edge point, for example."

Put another way, the Background section taught away with WORDS, and the rest of the specification and claims of Burns taught away with ACTIONS, i.e., the specific teaching of the invention of Burns.

Notwithstanding the teaching away in the Detailed Description, the teaching away in the Background section is adequate in itself to teach away from Applicant's invention. Since the invention itself of Burns further teaches away, the combination of the Background section with the remaining specification of Burns – taken together – is a stronger teaching away than either the Background or the remaining specification taken alone.

The Examiner states that "Burns merely states that there is a need for improvement with the prior art method of using indistinct features such as line junctions or elliptical arcs, but [Burns] does not exclude or teach away from using geometric models." However, one of average skill in the art of machine vision knows that a geometric model must include geometric elements (such as line junctions or elliptical arcs), and Burns is teaching that the very geometric elements taught by Applicant ("an arc or a line") are "**indistinct**", and thus by **disparaging** those geometric elements, is teaching away from the essential elements of geometric models, and therefore can clearly be said to **teach away from geometric models themselves**. See, for example, on page 1 of Applicant's Specification, lines 24-26, wherein it clearly states that "a geometric model of an object may comprise a set of geometric elements, each element comprising an arc or a line defining a substantial part of the object's geometry".

Then, the Examiner states that "Burns proposes an improvement to the well-known use of geometric models, thus providing motivation that it would be obvious to use line junctions or elliptical arcs". However, it's false that Burns teaches an improvement to the use of geometric models. Instead, Burns

teaches matching images using **model image patches**. See Burns, col. 4, lines 2-18. Image patches are portions of an image, and as such, contain only pixels, like any image, and therefore contain no geometric elements. Image patches are not geometric elements, and do not include geometric elements – they consist only of pixels. Since model image patches do NOT include geometric elements, they cannot be called geometric models, and certainly are not improved geometric models. Since the image patches are NOT improved geometric models, the Examiner's inference is FALSE that "it would be obvious to use line junctions or elliptical arcs".

Further, the Examiner cites Burns at col. 6, lines 23-26: the "encoding generally provides significantly more detailed information about image features than, for example, **mere** line junctions, elliptical arcs or edge points, for example." Compare this with what was already said disparaging line junctions and elliptical arcs in the Background section in col. 2, and it's clear that Burns is **again** disparaging when he says mere line junctions, elliptical arcs or edge points". Although the Examiner asserts "By use of the word "mere" it is interpreted that the image features could also include line junctions, elliptical arcs or edge points in addition to the improvements suggested by Burns, this assertion is merely an assertion without logic or evidence. The Examiner admits that "it is interpreted", but fails to demonstrate or prove this interpretation. In fact, one of average skill in machine vision would NOT make such an interpretation.

Then, the Examiner asserts that the "patches are two-dimensional", but this does NOT change the fact that the patches are NOT geometric part models, and all the claims now require "geometric part models".

Since Applicant has demonstrated that Burns does in fact teach away from using geometrical models, and Eibert relates to geometric models, Applicant's argument that Burns and Eibert are not combinable therefore is still cogent and relevant.

In response to Applicant's argument that there is no suggestion to combine, the Examiner asserts that "refinement of a model is within the knowledge generally available to one of ordinary skill in the art of image processing comparing images to identify an object", but does not explain the relevance of this assertion, and fails to support it. In fact, there are many ways to refine a model, and it could take undue experimentation by one of average skill in the art of machine vision to determine how to refine a model.

Examiner further asserts that "Eibert discloses that the invention provides a reliable system for object measurement, position, and attitude determination, and object classification", citing col. 1, lines 38-44, but again does not explain the relevance of this assertion.

Nevertheless, the Examiner reminds the Applicant that in Burns that the "patches are **two**-dimensional", and Applicant reminds the Examiner that Eibert deals with **three**-dimensional imaging and range imaging (col. 2, lines 29-55), and consequently, would not be viewed by one of average skill in the art of

machine vision as combinable. Accordingly, in view of the Examiner's remarks, Applicant deems that claim 1 is allowable.

Regarding claim 5, Burns deals with **parts** (image patches), and Eibert deals with representations of **whole** objects only, thereby providing yet another reason why one of average skill in the art of machine vision would not combine these references. The Examiner asserts that Eibert discloses providing for object measurement, position, and attitude determination (col. 1, lines 41-43), but the "object measurement" referred to here is of the object as a whole – Eibert is SILENT on measuring parts of objects, as required by claim 5. Eibert provides no information about the measurement or position of parts of objects.

The Examiner asserts that Burns discloses providing sufficient dimensional information about the features within an image patch to serve as the basis for computing pose estimates (col. 6, lines 35-40). However, Burns specifically states that only \*sufficient\* dimensional information is provided, but does not ever say that the actual "dimension" of a part of an object is provided, as required by claim 5. Moreover, claim 5 depends from allowable claim 1, further supporting the allowability of claim 5.

Regarding claims 6 and 7, the Examiner asserts that two-dimensional vectors are inherently included within the three-dimensional vectors of Eibert. However, Applicant asserts that Eibert does not teach anything to resolve the

inherent uncertainty as to which two dimensions of the three dimensions of the three-dimensional vectors would be useful or even possible to use, or if possible, how to use them. Moreover, claims 6 and 7 depend from allowable claim 1, further supporting the allowability of claims 6 and 7.

Regarding claim 8, Burns states that investigators in the field “suggest an iterative match refinement technique which, although potentially useful for verifying and improving a pose estimate after an object has been roughly detected and located, **is NOT particularly effective in recognizing an object in the first place.**” It’s important to notice that this citation is taken from col. 3, lines 19-23, which is in the BACKGROUND section. Thus, the PURPOSE of mentioning the “iterative match refinement technique” is to disparage it so as to make the invention of Burns more patentable, thereby teaching away from the “iterative match refinement technique”. Moreover, claim 8 depends from allowable claim 1, further supporting the allowability of claim 8.

Claims 1, 5-9, 13-17, and 21-24 have been rejected under 35 USC 103(a) as being unpatentable over Burns, US Pat. 5,828,769 (“Burns”), in view of Eibert et al. US Patent 5,621,807 (“Eibert”).

Claim 1 has been amended to make more clear that the object model is a **geometric** object model, and that the part models are **geometric** part models. By contrast, Burns teaches image patches and encoded image patches (col. 4, lines 1-26. Burns is silent on including any geometric data, or any other aspect

of a geometric model. In fact, Burns repeatedly teaches away from using geometric models, specifically stating that "indistinct features as, for example, line junctions, elliptical arcs or edge points" are to be avoided so as to arrive at an improved image recognition mechanism (col. 3, lines 24-30). There are many other references to the problems of using "line junctions, elliptical arcs or edge points", such as at col. 2, lines 1-8; col. 2, lines 17-19; and col. 2, lines 33-37. By contrast, on page 1 of the Specification, lines 24-26, it clearly states that "a geometric model of an object may comprise a set of geometric elements, each element comprising an arc or a line defining a substantial part of the object's geometry".

Further, since Eibert teaches geometric models, Burns is clearly teaching away from any combination with Eibert. Moreover, Eibert teaches three-dimensional geometric models in an image ranging context, which is very different from two-dimensional "image patch" models in Burns. This great difference suggests that such a combination would not be useful or functional, thereby further teaching away from combining Burns and Eibert.

Moreover, there is no suggestion to combine present in either reference. In particular, Burns is silent on refining the model. For example, looking at all the figures of Burns, there is not a single feed-back loop evident in the data flow diagram of Fig. 2. Thus, Burns does not contemplate improving a model. Instead, Burns uses "voting" among a plurality of local pose estimates, as shown in Fig. 2, to overcome problems with each individual model image patch.

Further, even if these references were combined, they would not provide the invention of claim 1, as herein amended, since amended claim 1 now requires **two-dimensional geometric** models, and **two-dimensional geometric** part models. Neither Burns or Eibert disclose two-dimensional geometric models, or two-dimensional geometric part models, and no possible combination of Burns and Eibert could provide these aspects that are now more clearly required by amended claim 1.

Yet further, Eibert does not teach part models, sub-models, or anything other than a complete whole geometric model. By contrast, Applicant teaches and claims geometric part models, i.e., geometric sub-models, that together form a geometric model. Burns does not repair this deficiency, since Burns does not teach geometric models, so Burns cannot teach geometric part models.

Consequently, the rejection of claim 1 under 35 USC 103(a) is deemed to be overcome.

Regarding claim 5, neither Eibert or Burns teach "determining the dimension of said part of said object", Eibert clearly because Eibert does not address parts, and measures only position and attitude of a large model. Burns also is silent on determining the dimensions of the image patches. Further, the Examiner is silent on any reference to substantiate the rejection. Moreover, claim 5 depends from amended claim 1, herein deemed to be allowable. Consequently, claim 5 is also deemed to be allowable.



Regarding claims 6 and 7, since Eibert relates to a three-dimensional system with three-dimensional vectors, and claims 6 and 7 now require two-dimensionality, claims 6 and 7 now do not read on Eibert. Further, claims 6 and 7 now depend from amended claim 1, herein deemed to be allowable. Consequently, claims 6 and 7 are also deemed to be allowable.

Regarding claim 8, the Examiner cites Burns at col. 3, lines 18-23 as teaching that it would be useful to use an iterative match refinement technique for improving a model after recognizing it. However, Burns actually teaches away from using an iterative technique, in fact stating at col. 3, lines 18-23: "Although Wu and Bhanu consider the use of a larger number of locally encoded patches, they suggest an iterative match refinement technique which, although potentially useful for verifying and improving a pose estimate after an object has been roughly detected and located, **is NOT particularly effective in recognizing an object** in the first place."

Further, Applicant refines a geometric model by refining its geometric part models, as clearly required by the first element of claim 8. By contrast, Eibert merely refines the whole model, because there are no constituent part models.

Moreover, claim 8 depends from amended claim 1, herein deemed to be allowable. Consequently, claim 8 is also deemed to be allowable.

Claims 9, 13, 14, 15, 16, 17, 21, 22, 23, and 24 were all rejected for analogous reasons, and analogous arguments are hereby advanced to show that

these claims too are allowable. Accordingly, the rejection of claims 9, 13, 14, 15, 16, 17, 21, 22, 23, and 24 under 35 USC 103(a) is deemed to be overcome.

Claims 2-4, 10-12, and 18-20 have been rejected under 35 USC 103(a) as being unpatentable over Burns, in view of Eibert, and further in view of Shum et al. US Patent 6,084,592 ("Shum").

Shum teaches three-dimensional models, and the amended claims now require two-dimensionality. Further, claim 2 depends from claim 1, deemed herein to be allowable. Accordingly, claim 2 is also deemed to be allowable, and the rejection of claim 2 under 35 USC 103(a) is deemed to be overcome.

Regarding claims 3 and 4, these claims are also deemed to be allowable for the same reasons as advanced regarding claim 2.

Regarding claims 10-12, and 18-20, these claims are analogous to claims 2-4, and are deemed allowable for the same reasons. Consequently, the rejection of claims 10-12, and 18-20 is deemed to be overcome.

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Accordingly, Applicants assert that the present application is in condition for allowance, and such action is respectfully requested. The Examiner is invited to phone the undersigned attorney to further the prosecution of the present application.

Respectfully Submitted,

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A handwritten signature in black ink, appearing to read 'Russ Weinzimmer', is written over a horizontal line.

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